Bee and Wasp Visitors to *Kallstroemia grandiflora* After Two Years of Drought

M. A. CAZIER AND E. G. LINSLEY[1]

In August, 1971, at a site along the Portal Road, two miles north of Rodeo, Hidalgo County, New Mexico, between the Arizona-New Mexico state line and U. S. highway 80, *Kallstroemia grandiflora* (Torrey) Gray was blooming profusely in large patches on each side of the road. At that time, the flowers were being visited by 15 species of bees (representing 11 genera and six families) and three species of wasps (representing three genera and two families) (Cazier and Linsley, 1974). Females of seven species of bees were gathering pollen and nectar from a position on top of the stamens, females, and/or males of seven species of bees and one of wasps were taking nectar only from the same position, females and/or males of three species of bees and one of wasps were taking nectar from beneath the stamens, and females and/or males of three species of bees and one of wasps were taking nectar from the underside of the flower (for a description and discussion of these various processes, see Cazier and Linsley, 1974).

During the summers of 1970 and 1973 no *Kallstroemia* seeds germinated within 10 miles of this site, but in 1974 the seeds germinated and the plants grew and again bloomed profusely in the same areas occupied in 1971. During the flowering period, other plants which compete with *Kallstroemia* for bee and wasp visitors, all of which are polylectic but often as individuals or local populations constant to particular pollen sources (bees), were scarcer than usual. This may account in part, at least, for the fact that half hour samples throughout a diurnal blooming cycle in mid-August (0800–1400 hours) yielded 951 bees of 25 species representing 15 genera and five families and 63 wasps of 12 species representing 10 genera and four families. The principal species of bees and wasps, those represented in the samples by five or more individuals, are listed by half hour (actually 29 minute) periods and kind of activity at the flowers in tables 1 and 2.

NOTES AND COMMENTS

As in 1971, the oxaeid *Protoxaea gloriosa* (Fox) was the largest and dominant species of bee visiting *Kallstroemia* flowers. However, indi-

[1] Department of Zoology, Arizona State University, Tempe, AZ 85281, and Department of Entomological Sciences, University of California, Berkeley, CA 94720 respectively.

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Table 1. Half hour samples of principal species of bees visiting *Kallstroemia grandiflora* during a diurnal blooming cycle in mid-August, 1974, two miles north of Rodeo, Hidalgo County, New Mexico. (PN = taking pollen and nectar from top of stamens, NS = taking nectar only from top of stamens, NBS = taking nectar only from beneath stamens, NUF = taking nectar only from underside of flower) *

Species			0800 0829	0830 0859	0900 0929	0930 0959	1000 1029	1030 1059	1100 1129	1130 1159	1200 1229	1230 1259	1300 1329	1330 1359	Totals
P. gloriosa	♀	PN	29	27	25	19	12	11	6	1					130
	♂	NS	5	12	7	4	5	13	4	15	13	13	5	6	102
P. sumichrasti	♀	PN	4	14	18	19	17	4	5	4	2	4	4	2	97
	♀	NS							1	9	6	3	2	4	25
	♂	NS									4	3	6	10	23
E. solani	♀	PN			2										2
	♀	NUF			1	6	5	7	5	5	13	13	9	7	71
	♂	NUF		2	1	4	1	2	11	9	5	6	4	5	50
M. limbus	♀	PN		1	1		2	1	3			2			10
	♀	NS			1		1		1						3
	♂	NS			2	1	2	7	3	23	21	14	8	8	89
Triepeolus spp.	♀	NS		1	1		1		4	2	2	3	7	7	28
	♂	NS		1	1	2		1	1	1	4	4	6	7	28
S. sabinensis	♀	PN		1				2		1	5	4			13
	♀	NS			1							4			5
	♂	NS										3	9	6	18

* Bee species referred to in Table 1 are *Protoxaea gloriosa* (Fox), *Ptilothrix sumichrasti* (Cresson), *Exomalopsis solani* Cockerell, *Melissodes limbus* LaBerge, *Triepeolus* spp., *Svastra sabinensis sabinensis* (Cockerell), *Diadasia ochracea* (Cockerell), *Melissodes thelypodii thelypodii* Cockerell, *Melissodes tristis* Cockerell, *Melissodes paroselae* Cockerell, *Agapostemon angelicus* Cockerell, *Psaenythia mexicanorum mexicanorum* (Cockerell), *Melissodes verbesinarum* Cockerell, *Nomia tetrazonata tetrazonata* Cockerell, *Svastra sila* (LaBerge), *Melissodes vernalis* LaBerge, and *Apis mellifera* Linnaeus.

Table 1. (Cont.)

Species			0800 0829	0830 0859	0900 0929	0930 0959	1000 1029	1030 1059	1100 1129	1130 1159	1200 1229	1230 1259	1300 1329	1330 1359	Totals
D. ochracea	♀	PN		1	1	1		1	1						5
	♀	NS								1					1
	♂	NS								1		1	2		4
M. thelypodii	♀	PN		2	1	1	1	1			2				8
	♀	NS								1					1
M. tristis	♀	PN		1				1							2
	♀	NS							1		2			1	4
M. paroselae	♀	PN										1			1
	♀	NS		1				1		1		1			4
A. angelicus	♀	NS		3	2										5
P. mexicanorum	♀	NS			1	1	1				1			1	5
M. verbesinarum	♀	PN							1	1					2
	♂	NS							2	2	6	2		3	15
N. tetrazonata	♂	NBS			2				3		1			1	7
S. sila	♀	PN					1				1	3	3		8
M. vernalis	♂	NS									1		5	10	16
A. mellifera	♀	PN								2	1				3
	♀	NUF		4	2	7	16	21	26	22	16	20	9	7	150
Totals			38	71	68	65	65	73	78	101	106	104	79	85	935

viduals of both sexes were even more numerous in 1974. Females with their remarkably developed pollen collecting scopae loaded with the bright red pollen were very conspicuous as they flew rapidly from flower to flower, alighting on and grasping the stamens as they rotated around to each of the five nectaries. Males were even more numerous and more conspicuous as they established territories throughout the fields of *Kallstroemia*, darting at other bees and insects and pausing periodically for rapid visits to several flowers for the nectar necessary for them to maintain their constant flight. During these flower visits the males became almost completely covered with pollen which adhered to their appendages and ventral surfaces in particular but also to the head and thoracic dorsum and abdominal apex. In this condition, the brightly colored pollen is very noticeable in the poising, darting bee. However, the males, which mass by the hundreds and "sleep" gregariously, remove the pollen from their bodies at or near the aggregation site before settling in for the evening. In 1974, the males formed their aggregations in the *Kallstroemia* fields, utilizing both the stiff branches of *Ephedra trifurca* Torrey and the comparatively flimsy stems of *Amaranthus palmeri* Watson. Mating pairs were found in the morning (e.g. 1047, 1050, 1109, 1115 hrs.) hanging from the petals beneath the *Kallstroemia* flowers.

In 1974, *Ptilothrix* sp. nr. *sumichrasti* (Cresson) was only slightly less abundant than *Protoxaea gloriosa* (122♀, 23♂: 130♀, 102♂), judging from our samples, the largest discrepancy being among males. Mating was not observed. This species was not found at the Rodeo *Kallstroemia* site in 1971, but in 1972, 3 females were taken while gathering pollen from flowers near Apache, Cochise County, Arizona, about 11 miles to the south.

Other bees well represented in 1974 that were absent or poorly represented in 1971, were *Triepeolus* spp. (one of these presumably parasitic in the nests of *Protoxaea gloriosa*), *Melissodes limbus* LaBerge, *Svastra sabinensis sabinensis* (Cockerell), *Melissodes verbesinarum* Cockerell, and *Melissodes vernalis* LaBerge. *Melissodes verbesinarum*, although represented by both sexes, did not appear until 1100 hrs., past the peak of activity of female *Protoxaea* and *Ptilothrix*.

Among the species of bees excluded from the table because they were represented in the samples by less than five individuals were *Pseudopanurgus verbesinae* Timberlake (♂), *Xenoglossodes eriocarpi* (Cockerell) (♂), *Psaenythia bancrofti* Dunning (♀, ♂), *Paranomada velutina* Linsley (♀) and *Triopasites micheneri* Linsley (♀). Each of these extract nectar from a position beneath the stamens, and each had

Table 2. Half hour samples of principal species of wasps visiting *Kallstroemia grandiflora* during a diurnal blooming cycle in mid-August 1974, two miles north of Rodeo, Hidalgo County, New Mexico. (NS = taking nectar from top of stamens, NBS = taking nectar from beneath stamens, NUHF = taking nectar from underside of flower) *

Species			0800 0829	0830 0859	0900 0929	0930 0959	1000 1029	1030 1059	1100 1129	1130 1159	1200 1229	1230 1259	1300 1329	1330 1359	Totals
B. u-scripta	♀	NUF	1	2									1		4
	♂	NUF	3	1	1										5
C. octomaculata	♀	NS				2	1		1	3		2	1	1	11
M. navajo	♀	NBS				2	1			2		1	2	1	9
M. frontale	♀	NBS					1			1		2	1		5
Myzinum sp.	♀	NUF				2				1	1	1		1	6
P. arizonicus	♀	NUF						1	1		2	1			5
A. occidentalis	♂	NBS							1	2		1		1	5
S. nobilitata	♂	NBS							1		2		1	1	5
Totals			4	3	1	6	3	1	4	9	5	8	6	5	55

* Wasp species in Table 2 are *Bembix u-scripta* (Fox), *Campsoscolia octomaculata texensis* (Saussure), *Myzinum navajo* Krombein, *Myzinum frontale* Cresson, *Myzinum* sp., *Pterocheilus arizonicus* Bohart, *Astata occidentalis* Cresson and *Scolia nobilitata fulviventris* Bart.

scattered pollen grains attached to the dorsum and appendages and parts of the ventral surface, the former presumably resulting from lightly brushing the stamens as they crawl beneath them, the latter presumably picked up accidentally from loose pollen in the base of the flower. (The pollen of *Kallstroemia* is so adhesive that it adheres to the body and appendages of such relatively naked parasitic bees as *Triepeolus* and *Nomada* which extract nectar from astride the anthers, and are thus capable of pollination.)

Excluded bees which take nectar from a position on top of the stamens include: *Svastra heliantharum* (Cockerell) (♀), *Melissodes subagilis* Cockerell (♂), *Melissodes brevipyga* LaBerge (♀), *Xenoglossodes* sp. (♀), and *Nomia micheneri* Cross (♂).

The principal species of bee taking nectar from beneath the flowers in 1974, as in 1971, was *Apis mellifera* Linnaeus. However, although in 1971 no individual worker was observed gathering *Kallstroemia* pollen, in 1974 three individuals were captured inside the flower and each was carrying *Kallstroemia* pollen. *Centris* spp., especially *C. atripes* Mocsary and *c. atriventris* Fox, frequently visit the underside of the flower for nectar, but they are readily disturbed at a distance of 5 to 10 ft. and are extremely difficult to sample without disturbing other flower visitors in the area.

Wasps excluded from the table were mostly individuals of species not taken previously at either the Rodeo or Apache sites and have not been identified.

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LITERATURE CITED

CAZIER, M. A. and E. G. LINSLEY. 1974. Foraging behavior of some bees and wasps at *Kallstroemia grandiflora* flowers in southern Arizona and New Mexico. American Museum Novitates, 2546: 1–20, figs. 1–6, tables 1, 2.